WHAT IS CLAIMED IS:

1   1.   A method for reducing toner in an image comprised of raster pel data,

2 comprising:

3   determining surrounding pels of subject pels;

4   for each subject pel, generating a sub-pulse width power to charge a sub-pel

5 region within the subject pel based on a pattern of the surrounding pels of the subject

6 pel; and

7   for each subject pel, generating position information indicating an alignment of

8 the sub-pel region in the pel, wherein the position information is used to position the

9 sub-pel region produced by the sub-pulse width power in the pel.

1   2.   The method of claim 1, wherein toner is attracted to the charged sub-

2 pel region.

1   3.   The method of claim 1, wherein the position information clusters the

2 sub-pel region of adjacent pels in order to reduce electrogmanetic radiation.

1   4.   The method of claim 1, further comprising:

2   for each subject pel, determining whether the pattern of the surrounding pels

3 indicates that the subject pel is in a black filled region, wherein the position

4 information is used to align the sub-pel region in the subject pel in the black filled

5 region to be adjacent to the sub-pel region in one adjacent subject pel in the black

6 filled region.

1   5.   The method of claim 4, wherein the alignment of the sub-pels forms a

2 checkerboard pattern.

1   6.   The method of claim 1, wherein the sub-pulse width power and

2 position information is encoded in a look-up table that provides one output sub-pulse

1 ~~width power and position information for an input subject pel and surrounding pel~~

2 pattern.

1   7.   The method of claim 4, wherein the surrounding pels include pels from

2 the scan line including the subject pel and from scan lines adjacent to the subject pel,

3 wherein the subject pel is in the black filled region if a plurality of the surrounding

4 pels are all black.

1   8.   The method of claim 7, wherein the subject pel is in the black filled

2 region if the plurality of the pels that surround the subject pel that are all black form a

3 cross shape.

1   9.   The method of claim 7, wherein the surrounding pels and subject pel

2 form a data window of pels, further comprising:

3   encoding pel positions in the data window to include location information of

4 the subject pel with respect to other pels if the subject pel is in one black filled region;

5 and

6   using the position information to align the sub-pel regions in the subject pels in

7 the black filled region to be adjacent to the sub-pel region in one adjacent subject pel

8 in the black filled region.

1   10.   The method of claim 9, wherein the data window forms a diamond

2 shape with the subject pel at the center of the diamond shaped window.

1   11.   The method of claim 9, wherein the sub-pulse width power and

2 position information are encoded in a look-up table that provides one output value

3 including sub-pulse width power and position information for an input subject pel and

4 surrounding pel pattern, and wherein the look-up table is encoded to provide the

5 position information that is used to align sub-pel regions in pels in the black filled

1 region to be adjacent to the sub-pel region in one adjacent subject pel for input data

2 windows that are encoded with position information.

1   12.   The method of claim 7, wherein the surrounding pels and subject pel

2 form a data window of pels, further comprising, for each subject pel:

3   determining from the pels in the data window whether the subject pel is on an

4 edge of an image of black pels; and

5   using the data window as input to a look-up table that provides one output

6 sub-pulse width power and position information for different input data window

7 patterns including patterns that indicate that the subject pel is in one black filled

8 region or on one image edge.

1   13.   The method of claim 12, wherein the look-up table is encoded to align

2 pels on the edge toward the black filled region.

1   14.   The method of claim 12, wherein the look-up table is encoded to

2 provide a sub-pulse width power level for pels on the edge that is less than the sub-

3 pulse width power level for pels in the black filled region.

1   15.   A system for reducing toner in an image comprised of raster pel data,

2 comprising:

3   means for determining surrounding pels of subject pels;

4   means for generating, for each subject pel, a sub-pulse width power to charge

5 a sub-pel region within the subject pel based on a pattern of the surrounding pels of

6 the subject pel; and

7   means for generating, for each subject pel, position information indicating an

8 alignment of the sub-pel region in the pel, wherein the position information is used to

9 position the sub-pel region produced by the sub-pulse width power in the pel.

1   16.   The system of claim 15, wherein toner is attracted to the charged sub-

2   pel region.

1   17.   The system of claim 15, wherein the position information clusters the

2   sub-pel region of adjacent pels in order to reduce electromagnetic radiation.

1   18.   The system of claim 16, further comprising:

2   means for determining, for each subject pel, whether the pattern of the

3   surrounding pels indicates that the subject pel is in a black filled region, wherein the

4   position information is used to align the sub-pel region in the subject pel in the black

5   filled region to be adjacent to the sub-pel region in one adjacent subject pel in the

6   black filled region.

1   19.   The system of claim 18, wherein the alignment of the sub-pels forms a

2   checkerboard pattern.

1   20.   The system of claim 15, wherein the sub-pulse width power and

2   position information is encoded in a look-up table that provides one output sub-pulse

3   width power and position information for an input subject pel and surrounding pel

4   pattern.

1   21.   The system of claim 17, wherein the surrounding pels include pels

2   from the scan line including the subject pel and from scan lines adjacent to the subject

3   pel, wherein the subject pel is in the black filled region if a plurality of the

4   surrounding pels are all black.

1   22.   The system of claim 21, wherein the subject pel is in the black filled

2   region if the plurality of the pels that surround the subject pel that are all black form a

3   cross-shape.

1 ~~23. The system of claim 21, wherein the surrounding pels and subject pel~~

2 form a data window of pels, further comprising:

3 means for encoding pel positions in the data window to include location

4 information of the subject pel with respect to other pels if the subject pel is in one

5 black filled region; and

6 means for using the position information to align the sub-pel regions in the

7 subject pels in the black filled region to be adjacent to the sub-pel region in one

8 adjacent subject pel in the black filled region.

1 24. The system of claim 23, wherein the data window forms a diamond

2 shape with the subject pel at the center of the diamond shaped window.

1 25. The system of claim 23, wherein the sub-pulse width power and

2 position information are encoded in a look-up table that provides one output value

3 including sub-pulse width power and position information for an input subject pel and

4 surrounding pel pattern, and wherein the look-up table is encoded to provide the

5 position information that is used to align sub-pel regions in pels in the black filled

6 region to be adjacent to the sub-pel region in one adjacent subject pel for input data

7 windows that are encoded with position information.

1 26. The system of claim 21, wherein the surrounding pels and subject pel

2 form a data window of pels, further comprising, for each subject pel:

3 means for determining from the pels in the data window whether the subject

4 pel is on an edge of an image of black pels; and

5 means for using the data window as input to a look-up table that provides one

6 output sub-pulse width power and position information for different input data

7 window patterns including patterns that indicate that the subject pel is in one black

8 filled region or on one image edge.

1   27.   The system of claim 26, wherein the look-up table is encoded to align

2   pels on the edge toward the black filled region.

1   28.   The system of claim 26, wherein the look-up table is encoded to

2   provide a sub-pulse width power level for pels on the edge that is less than the sub-

3   pulse width power level for pels in the black filled region.

1   29.   A computer-readable transmission medium including a look-up table

2   data structure used for reducing toner in an image comprised of raster pel data,

3   comprising:

4   a plurality of output values, wherein one output value is provided for at least

5   one pattern of pels including a subject pel, wherein the output value is substituted for

6   the subject pel, and wherein the output value comprises a sub-pulse width power to

7   charge a sub-pel region within the subject pel based and position information

8   indicating an alignment of the sub-pel region in the pel, wherein the position

9   information is used to position the sub-pel region produced by the sub-pulse width

10 power in the pel.

1   30.   The computer-readable transmission medium of claim 29, wherein

2   toner is attracted to the charged sub-pel region.

1   31.   The computer-readable transmission medium of claim 29, wherein the

2   position information clusters the sub-pel region of adjacent pels in order to reduce

3   electrogmanetic radiation.

1   32.   The computer-readable transmission medium of claim 29, wherein the

2   output values for subject pels in a black filled region include position information that

3   aligns the sub-pel region in the subject pels in the black filled region to be adjacent to

4   the sub-pel region in one adjacent subject pel in the black filled region.

1   ~~33.   The computer-readable transmission medium of claim 32, wherein the~~

2   position information for the output values of subject pels in the black filled region

3   aligns the sub-pel regions to form a checkerboard pattern.

1   34.   The computer-readable transmission medium of claim 33, wherein the

2   subject pels are in the black filled region if a plurality of the surrounding pels are all

3   black.

1   35.   The computer-readable transmission medium of claim 34, wherein the

2   subject pel is in the black filled region if the plurality of the pels that surround the

3   subject pel that are all black form a cross shape.

1   36.   The computer-readable transmission medium of claim 29, wherein the

2   surrounding pels for which an output value is provided in the look-up table data

3   structure form a diamond shape with the subject pel at the center of the diamond

4   shaped window.

1   37.   The computer-readable transmission medium of claim 29, wherein the

2   output values for subject pels on an image edge are encoded with position information

3   to align the subject pels on the image edge toward a black filled region.

1   38.   The computer-readable transmission medium of claim 29, wherein the

2   output values for subject pels on the image edge are encoded with a sub-pulse width

3   power level that is less than the sub-pulse width power level for pels in the black filled

4   region.